Research on Commercial Patterns of China Existing Building Energy Retrofit Based on Energy Management Contract

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Abstract: Existing building energy retrofit is one of the keys of building energy efficiency in China. According to experience in developed countries, implementation of energy management contract (EMC) is crucial to promote existing building energy retrofit, which means that the reduction of energy expenditure is used to pay the retrofit cost. The EMC program has a short payback period, high interior return rate and remarkable energy savings. This paper present the specialties and difficulties of existing building energy conservation in China and the development, service items and commercial patterns of EMC. We discuss the main methods and ways that EMC is applied to existing building energy retrofit at the original stage of building energy efficiency by analyzing the difference of EMC and other traditional energy efficiency patterns. Based on the analysis of three commercial patterns of EMC including guaranteed savings contract, shared savings contract and chauffage contract, we propose that the guaranteed savings contract is the main development direction of building energy efficiency service in China. At the same time, new financing methods and energy-saving measurement and verification standards should be established to ensure that EMC plays an important role in the process of existing building energy retrofit in China.

Key words：building energy retrofit; energy management contract (EMC); commercial pattern; energy efficiency financing; measurement and verification (M&V)

1. INTRODUCTION

1.1 Current Building Energy Consumption in China

Building energy consumption refers that energy consumption in the process of building usage, including heating, cooling, illumination, hot water, kitchen work and other power appliances. At present urban and rural civil building electricity consumption accounts for 22%~24% of our country total output of electrical energy. Northern heating coal consumption occupies 15%~18% of our country non-electricity generation. The data only calculates building energy consumption in the process of usage, not including energy consumption of building material production and building construction. Now the building energy consumption in developed countries generally occupies 1/3 of the total energy consumption. Along with the development of urbanization in China, the enlargement of the tertiary industry in GDP proportion and the adjustment of the manufacturing industry structure, the building energy consumption proportion continues to increase, finally approaches 33%, which is the level in developed countries. According to the research on energy in recent 30 years, building energy-saving is regarded as having the biggest potential, the most direct effective way. Building energy-saving is one of the most effective

measures to solute the contradictory of energy insufficient supply and social economy development[1].

1.2 Question Existing Building Energy Retrofit Faced with in China

In the "fifteenth" period, the total floor area of energy-saving building will exceed 2.16 billion m^2. At present, there are 13 billion m^2 of existing building to carry on the energy retrofit in China. Suppose the energy retrofit expense is 100~200RMB/m^2, the total retrofit expense will amount to 2,000 billion RMB. So, how to raise the energy retrofit money are the crucial question existing building energy retrofit faced with in China.

Although solving the question needs many polices to carry on together, including government fund support, it is impossible to depend on the government to invest so huge fund demand. According to the overseas experience, the probable feasible way is to introduce the new energy efficient mechanism—energy management contract to the energy retrofit market. There are several energy service companies (ESCO) in China, most of them focus on industry energy efficiency. This paper presents the application of energy management contract in existing building energy retrofit is the main way to solve the question existing building energy retrofit faced with.

2. ANALYSIS ON COMMERCIAL PATTERNS OF ENERGY MANAGEMENT CONTRACT

2.1 Energy Management Contract

Energy management contract (EMC) is one kind of commercial pattern that through the contract that energy saving company signs with the client or customer, and provides following services: energy system auditing, energy-saving feasibility analysis, energy-saving project design, energy efficiency financing; choosing and purchasing equipment, installing and debugging, carrying on the project management, training operator, maintenance equipment in the contract time, measurement & verification(M&V) and so on, a series of services, finally recoups the investment and obtains the profit from energy-saving benefit.

2.2 Commercial Patterns of Energy Management Contract

2.2.1 Guaranteed Savings Contract[2]

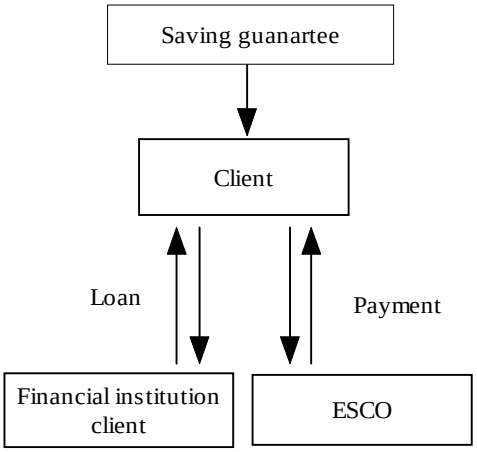

Fig. 1 Guaranteed savings contract

Guaranteed savings contract is the most common type of EMC. The contractor will guarantee the amount of energy savings that can be achieved by the client and compensate the client if these are not attained. Typically this contract would require the client or a third party to finance any actions taken. In guaranteed savings contract,all the contractor's costs (equipment, installation, mark-up, fees and so on) are repaid annually out of the savings as they accrue. The length of the contract (typically four to eight years) is usually chosen so that all costs are paid for out by the end of the contract period[3][4]. Fig.1 shows the relations of the client and ESCO and financial institution client.

2.2.2 Shared Savings Contract

Energy savings achieved under this type of contract are shared between the client and the contractor over a set period of time. Under this arrangement the contractor is usually responsible for financing the project with capital being repaid from any savings made.In this arrangement, the client and the contractor agree to share the savings over the contract period according to an agreed formula. The actual cost of the measures is not included in the contract, and the client has no obligation to pay off

those costs. In return, the performance contractor does not guarantee the savings. Contract terms are usually longer (up to 10 years) because it takes longer for the investment to be recovered, and the risks to the contractor are higher.

Shared savings is most appropriate when a facility owner is concerned with obtaining the quickest possible positive cash flow.

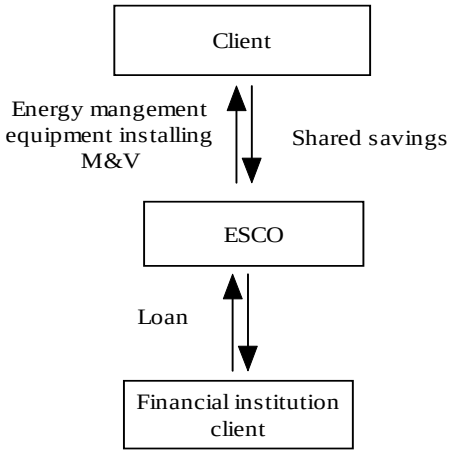

Fig. 2 Shared Savings Contract

An advantage of this option to the energy management company is the opportunity to maximize profits on the spread between its costs and the share of savings. The energy service company controls the level of investment and will maintain strategy of short payback measures: minimum investment to produce maximum savings levels.

2.2.3 Chauffage Contract

Chauffage contract allows ESCO to charge a fixed fee and in return the client receives a guaranteed level of service. ESCO covers all aspects of energy usage including paying utility bills and maintenance.

ESCO effectively takes over the operation of a client's utility or production facilities as well as upgrading them, and often pays the client's utility bills as well. The client pays ESCO a regular fee equal to the utility bills before the project or some other negotiated fee. In this type of financing agreement, ESCO guarantees that the facility owner's energy costs will be lower than they would have been without an energy performance contract.

The chauffage contract is usually very extensive, often involving a total energy management plan, including retrofits and maintenance. It is generally considered appropriate only for large scale energy users, where the value of potential savings is substantial, such as hospitals, universities, and large office complexes. The length of a chauffage contract is usually between seven and 10 years.

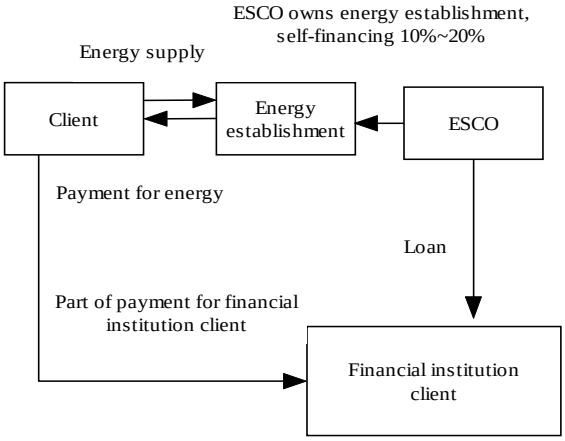

Fig. 3 Chauffage Contract

Out of the payments received, ESCO must recover all of its expenses for equipment and services, as well as pay the energy bills. ESCO must reduce actual energy costs significantly below what it charges; its profit equals this gross margin less the costs to design, install and maintain the retrofits.

2.3 Energy Management Contract Commercial Patterns Comparison

According to the above analysis, Tab.1 shows comparison of savings not achieved and savings achieved and savings exceeded of three kinds of contract. At current period in China, ESCO who can supply energy for building is few. So chauffage contract is not suitable for Chinese existing building energy retrofit. The type of contract undertaken determines how energy savings are distributed.

Tab. 1 summarizes the features of the guaranteed and shared savings models.

Tab. 1 Comparison of energy savings distributed

Contract type	Savings not achieved	Savings achieved	Savings exceeded
Guaranteed savings	ESCO pays the client	The client take savings and pay	The client take savings and pay ESCO (payment

		ESCO	may include a bonus)
Shared savings	ESCO pays the client	The client share savings with ESCO	The client share savings with ESCO
Chauffage	ESCO takes loss	ESCO takes savings	ESCO takes savings

Tab. 2 Comparison of guaranteed savings and shared savings

Guaranteed savings	Shared Savings
Performance related to level of energy saved	Performance related to cost of energy saved
Value of energy saved is guaranteed to meet debt service obligations down to a floor price	Value of payments to ESCO is linked to energy price
ESCO carries performance risk	ESCO carries performance and credit risk as it typically carries out the financing
Energy-user/customer carries credit risk	
If the energy-user/customer borrows, then debt appears on its balance sheet	Usually off the balance sheet of energy user/customer
Requires creditworthy customer	Can serve customers that do not have access to financing, but still requires a creditworthy customer
Extensive M&V	Extensive M&V
ESCO can do more projects without getting highly leveraged	Favours large ESCOs; small ESCOs become too leveraged to do more projects
More comprehensive project scope due to lower financing costs	Favours projects with short payback (‘cream skimming’) due to higher financing costs

Sources of data: Dreessen 2003, Hansen 2003 and 2004, Poole and Stoner 2003

Origin:《ESCO reports final revised v2》

Tab. 2 shows the comparison of guaranteed savings and shared savings. The comparison factors include energy-saving performance, value of energy saved or payment, risk, balance sheet, customer, M&V, ESCO financing. From the tab.2, guaranteed saving contract is suitable for the development of small ESCO. At the first step of existing building energy retrofit, many small ESCOs are emerging and rather easy financing method is important for them.

So, guaranteed savings contract is practical for existing building energy retrofit in China.

2.4 Energy-saving M&V

Energy-saving M&V standard is one crucial factor to develop energy management contract. M&V standard determines the specific savings of both parties in energy management contract[5]. To implement energy management contract, it is prerequisite to establish Chinese M&V standard. M&V standard may achieve the following effects: (1) Clearly knowing about the amount of the energy-saving and energy expense; (2) Guaranteeing and keeping operational performance of the improvement equipment maintenance; (3) Enhancing the reliability of ESCO guarantee to save the energy savings; (4) The client can appropriately appraise the improvement effect when it is unable to make the guarantee for ESCO.

3. COMMERCIAL PATTERN OF EXISTING BUILDING ENERGY RETROFIT BASED ON ENERGY MANAGEMENT CONTRACT

3.1 Commercial Patterns of Existing Building Energy Retrofit

From above analysis, it can be concluded that guaranteed savings contract pattern is suitable for the building energy retrofit market, including: (1)ESCO can do more projects without getting highly leveraged ; (2)ESCO can implement more comprehensive project scope due to lower financing costs.

At present, existing building energy retrofit service should take guaranteed savings contract as the main development direction. Thus Energy management contract can play the vital role in the existing building energy retrofit.

3.2 Proposals to Implement Existing Building

Energy Retrofit Commercial Patterns

(1) Establish Chinese M&V protocol as soon as possible.

(2) Carry on the corresponding economical drive policy to ESCO, solve the ESCO financing.

(3) The government should take the lead to implement the Energy management contract mechanism in order to drive the Energy management contract market.

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